26. Determine la temperatura en la cual una chapa de cobre de área 10 m² a 20 °C adquiere el valor de 10,0056 m². Considere el coeficiente de dilatación superficial del cobre es $34*10^{-6}$ 1/°C.

$A_0 = 10\,[m^2]$ $\quad T_0 = 20^\circ C$

$A = 10.0056\,[m^2]$ $\quad T = ?$

$\gamma = 2\alpha = 34.10^{-6}\ ^\circ C^{-1}$

$$\Delta A = A_0\, 2\alpha\, \Delta T$$

$$\Delta A = A_0\, \gamma\, \Delta T$$

$$\Delta T = \frac{\Delta A}{A_0\, \gamma}$$

$$\Delta T = \frac{A - A_0}{A_0\, \gamma}$$

$$T = T_0 + \frac{A - A_0}{A_0\, \gamma}$$

$$T = 20 + \frac{10.0056 - 10}{10 \times 34 \times 10^{-6}}$$

$$T = 36.47\ ^\circ C$$

27. (*)Una esfera de acero de radio 5,005 cm es colocada sobre un anillo de zinc de 10 cm de diámetro, ambos a 0 °C. ¿Cuál es la temperatura en la cual la esfera pasa por el anillo? Sabiendo que: α_{zinc} = 0,000022.1/°C y α_{acero} =0,000012.1/°C.

$R_a = 5.005\ [cm]$ $\quad T_o = 0°C$

$d_z = 10\ [cm]$ $\quad T_o = 0°C$

$T = ?$

$\alpha_z = 2.2 \times 10^{-5}\ °C$ $\quad \alpha_a = 1.2 \times 10^{-5}\ °C$

$R_a = 0.05005\ [m]$

$d_a = 0.1001\ [m]$

$d_z = 0.1\ [m]$

Sabemos

$$\Delta d = d_o \alpha \Delta T$$

$$d_z = d_{z_o}(1 + \alpha_z \Delta T) \quad \ldots \text{ec 1}$$

$$\Delta V = V_o\, 3\alpha\, \Delta T$$

$$V_a = V_{a_o}(1 + 3\alpha_a \Delta T)$$

$$\frac{4}{3}\pi R_a^3 = \frac{4}{3}\pi R_{a_o}^3 (1 + 3\alpha_a \Delta T)$$

$$\frac{4}{3}\pi\frac{d_a^3}{2^3} = \frac{4}{3}\pi\frac{d_{a_0}^3}{2^3}(1+3\alpha_a\Delta T)$$

$$d_a^3 = d_{a_0}^3(1+3\alpha_a\Delta T)$$

Condición

$$d_z = d_a$$

$$d_z^3 = d_a^3$$

$$d_{z_0}^3(1+\alpha_z\Delta T)^3 = d_{a_0}^3(1+3\alpha_a\Delta T)$$

$$d_{z_0}^3(1^3+3\cdot1^2\cdot\alpha_z\Delta T+3\cdot1\cdot\alpha_z^2\Delta T^2+\alpha_z^3\Delta T^3) = d_{a_0}^3+d_{a_0}^3 3\alpha_a\Delta T$$

$$d_{z_0}^3+d_{z_0}^3 3\alpha_z\Delta T = d_{a_0}^3+d_{a_0}^3 3\alpha_a\Delta T$$

$$d_{z_0}^3 3\alpha_z\Delta T - d_{a_0}^3 3\alpha_a\Delta T = d_{a_0}^3 - d_{z_0}^3$$

$$\Delta T\, 3(d_{z_0}^3\alpha_z - d_{a_0}^3\alpha_a) = d_{a_0}^3 - d_{z_0}^3$$

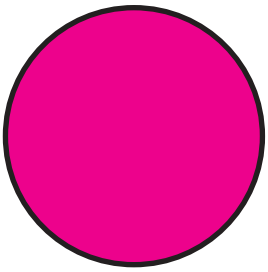
$$T = T_0 + \frac{d_{a_0}^3 - d_{z_0}^3}{3(d_{z_0}^3\alpha_z - d_{a_0}^3\alpha_a)}$$

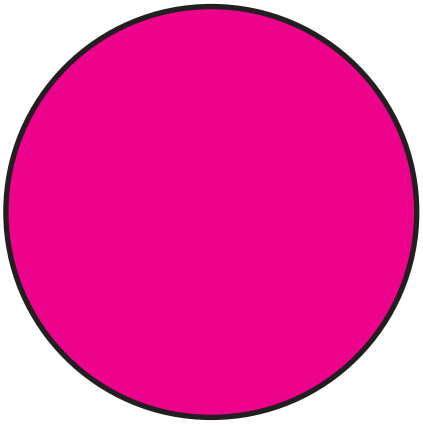
$$T = \frac{d_{a_0}^3 - d_{z_0}^3}{3(d_{z_0}^3\alpha_z - d_{a_0}^3\alpha_a)}$$

$$T = \frac{0.1001^3 - 0.1^3}{3\left[0.1^3 (2.2\times10^{-5}) - 0.1001^3 (1.2\times10^{-5})\right]}$$

$$T = 100.46\ ^\circ C$$

29. (*)Un disco de plomo tiene a la temperatura de 20 °C; 15 cm de radio. ¿Cuáles serán su radio y su área a la temperatura de 60 °C? Sabiendo que: α_{plomo} =0,000029 1/°C.





$T_o = 20^\circ C$

$R_o = 15[cm] = 0.15[m]$

$A_o = \pi R_o^2$

$A_o = 0.0707\ [m^2]$

$T = 60^\circ C$

$R = ?$

$A = ?$

a) $\Delta R = R_o\, \alpha\, \Delta T$

$R = R_o(1 + \alpha \Delta T)$

$R = 0.15\left[1 + 2.9\times10^{-5}(60-20)\right]$

$R = 0.150174\ [m]$

$R = 15.0174\,[cm]$

b)

$$\Delta A = A_o 2\alpha \Delta T$$

$$A = A_o (1 + 2\alpha \Delta T)$$

$$A = 0.0707\left[1 + 2\left(2.9 \times 10^{-5}\right)(40)\right]$$

$$A = 0.070864\,[m^2]$$

$$A = 708.64\,[cm^2]$$